

Claims

- [c1] 1.A fuel cell apparatus comprising a vertically repeating series of fuel cell units (10) wherein each unit comprises:
- (a)an interconnect having an anode-facing surface and a cathode-facing surface and defining a fuel intake manifold, a fuel exhaust manifold, an air intake manifold and an air exhaust manifold;
 - (b)a planar fuel cell having a cathode and an anode and, optionally, a fuel cell holder plate, wherein the fuel cell or fuel cell holder plate defines a fuel intake manifold, a fuel exhaust manifold, an air intake manifold and an air exhaust manifold, each of which align vertically with a corresponding manifold in the interconnect;
 - (c)a cathode gasket seal disposed between the fuel cell or fuel cell holder plate and the cathode-facing surface of the interconnect and defining a cathode flow field wherein the air intake manifold and the air exhaust manifold are within the cathode flow field;
 - (d)an anode gasket seal disposed between the fuel cell or fuel cell holder plate and the anode-facing surface of the interconnect and defining an anode flow field wherein the fuel intake manifold and fuel exhaust manifold are within the anode flow field;

(e) first and second fuel manifold seals disposed between the fuel cell holder plate and an interconnect for isolating each of the fuel intake and exhaust manifolds respectively; and

(f) first and second air manifold seals disposed between the fuel cell holder plate and an interconnect for isolating each of the air intake and exhaust manifolds respectively.

2. The apparatus of claim 1 wherein the cathode gasket seal, and first and second fuel manifold seals are formed by a single seal element.

[c2] 3. The apparatus of claim 1 wherein the anode gasket seal, and first and second air manifold seals are formed by a single seal element.

[c3] 4. The apparatus of claim 1 further comprising a first porous contact material disposed between the cathode and the cathode-facing surface of the interconnect, within the cathode flow field, and a second porous contact material disposed between the anode and the anode-facing surface of the interconnect, within the anode flow field.

[c4] 5. The apparatus of claim 1 wherein the cathode surface of the upper interconnect comprises flow directing ribs for distributing air relatively evenly along the fuel cell

cathode surface.

- [c5] 6.The apparatus of claim 5 wherein the flow directing ribs are stamped into the interconnect.
- [c6] 7.The apparatus of claim 1 wherein the fuel cell unit has a footprint comprising a substantially quadrilateral shape and wherein each of the anode gas chamber and the cathode gas chamber are disposed diagonally across the footprint.
- [c7] 8.The apparatus of claim 7 wherein the footprint comprises a substantially rectangular shape.
- [c8] 9.The apparatus of claim 8 wherein the fuel cell is hexagonal wherein first opposing lateral sides of the fuel cell borders first and second lateral edges of the fuel cell holder plate, second opposing lateral sides of the fuel cell border the air intake and exhaust manifolds respectively and third opposing lateral sides border the fuel intake and exhaust manifolds.
- [c9] 10.The apparatus of claim 1 wherein a leak path gap is provided between the cathode gasket seal and the first and second fuel manifold seals.
- [c10] 11.The apparatus of claim 1 wherein a leak path gap is provided between the anode gasket seal and the first

and second air manifold seals.

- [c11] 12.A fuel cell stack comprising alternating layers of interconnects, seals, fuel cells and defining a horizontal anode flow field in fluid communication with a vertical fuel intake manifold and a vertical fuel exhaust manifold, and further defining a horizontal cathode flow field in fluid communication with a vertical air intake manifold and a vertical air exhaust manifold, wherein each of the anode flow field and the cathode flow field is horizontally contained by a compressible seal.
- [c12] 13.The fuel cell stack of claim 12 wherein the fuel cell stack has a footprint comprising a substantially rectangular shape.
- [c13] 14.The fuel cell stack of claim 13 wherein the anode flow field and the cathode flow field are each disposed diagonally across the stack footprint.
- [c14] 15.The fuel cell stack of claim 14 wherein each fuel cell comprises a hexagonally shaped anode surface and a hexagonally shaped cathode surface, each exposed to the anode flow field and cathode flow field respectively.